

LEAF PROTEIN CONCENTRATE IN HUMAN DIET*

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Abstract. The work was undertaken with a view of increasing the nutritive value of common Pakistani dishes. The dry matter, nitrogen content, fibre and organoleptic evaluation were analysed accordingly.

The present gap between production and consumption of protein in Pakistan can be bridged if all the resources, i.e. conventional as well as unconventional are exploited. One of the unconventional sources of protein is green leaves and grasses. A process for extraction of proteins from leaves was developed by Morrison and Pirie.¹ Proteins from leaves available in Pakistan were extracted by Nazir and Shah.² The effect of heat on the digestibility of leaf protein concentrate was discussed by Shah *et al.*³

Leaf protein can be incorporated into different dishes according to the dietary habits of the country in which it is to be used. But the proof of the pudding is in the eating. Pirie⁴ prepared dishes from leaf protein concentrate and evaluated the products.

The present study involves incorporation of leaf protein concentrate (LPC) extracted from grasses, into Pakistani dishes to increase their nutritive value.

Material and Methods

Mixed grasses were used for extraction of protein and IBP pulper and press was employed.^{6,7}

Recipes

The following dishes were prepared:

Potato Paratha

Sample A. Ingredients:	
Boiled potatoes	45 g
Flour dough (95% extn. 70% water)	60 g
Red chillies	1/8 teaspoon
Green chillies	1 "
Salt	1/2 "
Pomegranate seeds	1/2 "
Cumin seeds	1/8 "
Coriander dry	1/4 "
Coriander green	1 "
Fat for frying	
Sample B. Sample A+3 g LPC	
Sample C. Sample A+4 g LPC	
Sample D. Sample A+5 g LPC	

Pappar

Sample A. Ingredients:

Black gram powder	40 g
Salt	1/2 teaspoon
Red chillies	1/4 "
Pepper	1/4 "
Coriander dry	1/4 "
Soda bicarb	1/4 "
Fat for frying.	

Sample B. Sample A+3 g LPC

Sample C. Sample A+4 g LPC

Sample D. Sample A+5 g LPC

Cutlets

Sample A. Ingredients:

Potatoes boiled	60 g
Red chillies	1/4 teaspoon
Salt	1/2 "
Pomegranate seeds (dried)	1/2 "
Egg	1
Fat for frying	

Sample B. Sample A+3 g LPC

Sample C. Sample A+4 g LPC

Pakorras

Sample A. Ingredients:

Gram powder	100 g
Potatoes	100 g
Soda bicarb	1/2 teaspoon
Red chillies	1 "
Green chillies	1/2 "
Salt	1 "
Pomegranate seeds (dried)	1/2 "

Sample B. Sample A+5% LPC

Samosas

Sample A. Ingredients:

Patent flour	15 g
Boiled potatoes	25 g
Salt	1/4 teaspoon
Cumin seeds	1/4 "
Pomegranate seeds (dried)	1/4 "
Fat for frying	

Sample B. Sample A+2 g LPC

Sample C. Sample A+3 g LPC

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Sewian

Sample A. Ingredients:	
Rice powder	400 g
Salt	2 teaspoon
Chillies	$\frac{1}{2}$ "
Soda bicarb	$\frac{1}{4}$ "
Fat for frying	

Sample B. Sample A + 40 g LPC

Bread and Potato Sandwich

Sample A. Ingredients:	
Bread	2 slices
Butter	4 g
Cumin seeds	$\frac{1}{8}$ teaspoon
Boiled potatoes	40 g
Salts	$\frac{1}{4}$ teaspoon
Chillies	$\frac{1}{8}$ "
Pepper	$\frac{1}{8}$ "

Sample B. Sample A + 2 g LPC

Sample C. Sample A + 3 g LPC

Vegetable Sandwich

Sample A. Ingredients:	
Bread	2 slices
Butter (a thin spread for 2 slices)	
Cucumber	3 round cuts
Tomatoes	3 thin round pieces
Mint	1 g
Mustard	1 g
Pepper and salt as per taste	
Tomato sauce	$\frac{1}{2}$ teaspoon

Sample B. Sample A + 2 g LPC

Sample C. Sample A + 3 g LPC

Dahi Bhale

Sample A. Ingredients:	
Black gram	185 g
Soda bicarb	$\frac{1}{2}$ teaspoon
Red chillies	$\frac{1}{4}$ "
Salt	$\frac{1}{2}$ "
Cumin seeds	$\frac{1}{4}$ "
Yoghurt	1 lb
Fat for frying	

Sample B. Sample A + 40 g LPC

Sample C. Sample A + 50 g LPC

Analytical

Dry Matter (DM) Percentage. The sample was weighed and kept overnight in an oven at 100°C. DM percentage was calculated from the loss of weight.

Nitrogen. Protein was estimated by a microkjeldahl method using selenium mixture which has SeO_2 - K_2SO_4 - CuSO_4 in the ratio 2:900:100. A factor of 6.0 was employed for conversion of nitrogen into protein.

Fat. Fat was extracted in a Soxhlet extractor for 18 hr using hexane as a solvent.

Fibre. Fibre was estimated by A.O.A.C.'s method.

Organoleptic Evaluation. LPC was incorporated into various dishes in different concentrations and the product was evaluated by a panel of experienced judges. A score card including colour, taste, texture and flavour was used.

Results and Discussion

Nine dishes which are popular in local dietaries were prepared. LPC was incorporated in these dishes in different concentrations. A standard recipe without leaf protein was used for purposes of comparison. A representative sample of each dish was dried, ground and the particles which passed through 60 mesh were used for further analysis.

Table 1 shows dry matter, protein, fat and fibre contents of various dishes with and without fortification with leaf protein concentrate. The increase in protein content ranged from 6.7 to 89.3% which shows an improvement in the nutritive value of all the samples.

The 'parathas' containing 3 and 4 g LPC per piece, showed an increase in protein by 22.5 and 89.3% respectively. The increase in protein content of 'pappar' to which 2, 3 and 4 g LPC was added per piece was 41.2, 54.4 and 73.4% respectively.

Cutlets when fortified with LPC at the rate of 3 and 4 g per piece, showed an increase of 6.72 and 13.6% in the protein content. Similarly addition of LPC to 'samosas' at the rate of 3 and 4 g LPC per piece, increased its protein content by 23.8 and 52.7%.

The increase in protein content of 'sewian', 'bread and potato sandwiches', 'vegetable sandwich', 'dahi bhale' after addition of LPC is given in Table 2.

It can be seen that the increase in protein contents, after fortification, was 96% in case of 'sewian', 15.1 and 51.1% in bread and potato sandwiches, and 23.5 and 43.3% in vegetable sandwiches. The increase in protein contents of 'dhai bhale', on DM basis, was comparatively lesser than other products but addition

TABLE 1. PROXIMATE ANALYSIS OF LPC CONTAINING DISHES.

Product		Dry matter (%)	Protein (%)	Protein increase (%)	Fat (%)	Fibre (%)
Potato paratha	A	31.7	6.5		4.5	5.8
	B	48.2	7.9	22.5	3.2	5.9
	C	52.4	21.3	89.3	5.0	5.8
Cutlets	A	58.0	5.5		14.9	6.0
	B	56.0	5.9	6.7	6.1	6.5
	C	56.0	6.3	13.6	7.7	6.4
Samosa	A	65.05	3.7		18.7	4.2
	B	72.1	4.4	23.8	17.1	4.8
	C	69.1	5.6	52.7	17.8	8.8
Pakorras	A	77.0	8.1		4.9	10.2
	B	66.5	8.2	0.86	4.7	11.3
Pappar	A		7.2		8.3	3.6
	B		10.2	41.2	5.4	3.2
	C		11.1	54.4	3.0	3.3

TABLE 2. PROXIMATE ANALYSIS OF LPC CONTAINING DISHES.

Product		Dry matter (%)	Protein (%)	Protein increase%	Fat (%)	Fibre (%)
Sewian	A		7.8		8.5	2.5
	B		15.4	96	7.7	2.6
Bread potato sandwich	A	61.3	11.13		10.0	4.8
	B	50.0	12.81	15.1	7.8	5.4
	C	45.7	16.8	51.1	10.6	3.7
Vegetable sandwich	A	60.2	5.6		9.6	5.1
	B	50.0	6.9	23.5	9.2	5.8
	C	45.7	8.0	43.3	7.8	4.1
Dahi bhale	A	56.6	20.8		8.5	5.7
		32.3	23.8	14	7.9	3.6

TABLE 3.

Sample	LPC	Organoleptic evaluation
Potato paratha	3 g	Highly acceptable
Pappar	4 "	" "
Cutlets	3 "	" "
Pakorras	5%	" "
Samosas	3 g	" "
Sewian	10%	" "
Bread and potato sandwich	3 g	" "
Sandwich	3 "	" "
Dahi bhale	3 "	" "

of LPC improved the texture and taste of the product to a great extent.

The dishes fortified with 3 g LPC were highly acceptable (Table 3). Pakoras containing 5% and sewian 10% LPC were also highly acceptable. LPC also imparted crispness to 'sewian' and 'pappar' which is very much desirable and was lacking in the standard recipe.

TABLE 4.

Sample	LPC	Organoleptic evaluation
Potato paratha	4	Acceptable
Pappar	5	"
Cutlets	4	"
Samosas	4	"
Bread and potato sandwich	4	"
Sandwich	4	"
Dahi bhale	4	"

The dishes which had a higher concentration of LPC are given in Table 4. These dishes were comparatively less acceptable than those which had a lower concentration of LPC. Higher concentration of LPC in these dishes adversely affected the taste and flavour of the products. Further tests and changes in the recipes may improve their acceptability.

Generally 2-3 pieces of the above-mentioned preparation are taken at a time. Fortification of these with LPC could go a long way in meeting needs of protein deficient people.

References

1. J.E. Morrison and N.W. Pirie, *J. Sci. Food, Agr.*, **12**, 1(1961).
2. M. Nazir and F. H. Shah, *Pakistan J. Sci. Ind. Res.*, **9**, 235, (1966).
3. F.H. Shah, Riaz-ud-Din and A. Salam, *Pakistan J. Sci. Ind. Res.*, **10**, 39(1967).
4. N.W. Pirie, *Science*, **152**, 1701 (1966).
5. *Official Methods of Analysis* (Association of Official and Agricultural Chemists, Washington, 1960) ninth edition, pp. 22. 038, 288.
6. M. N. G. Davy and N. W. Pirie, *Biotech. Bioengg.*, **11**, 517 (1969).
7. M.N.G. Davys, N.W. Pirie, and G. Street, *Biotech. Bioengg.*, **11**, 528 (1969).